CLAIMS

1. A heat exchanger finned tube which has a fin fixing tube having a straight tube portion and comprising a tube having no weld seam, and a fin group comprising a plurality of parallel plate fins fixed to the straight tube portion of the fin fixing tube, the straight tube portion having at least one finless part provided with no fin group, each of the plate fin having a tube inserting hole, the fin fixing tube having its straight tube portion inserted through the holes of the plate fins and being enlarged with use of a fluid to thereby fixedly fit the plate fins around the straight tube portion, the finless part of the straight tube portion having an outer peripheral surface bearing annular clamp marks left by clamping the straight tube portion over the entire circumference thereof when the fin fixing tube is enlarged.

2. A heat exchanger finned tube according to claim 1 wherein the fin fixing tube is in the form of a hairpin, and a plurality of fin groups are arranged on two straight tube portions of the fin fixing tube longitudinally thereof at a spacing, each of the fin groups comprising a plurality of parallel plate fins extending across and fixed to the two straight tube portions, each of the plate fins having two tube inserting holes spaced apart from each other, the fin fixing tube having its straight tube portions inserted through the respective holes of the plate fins, the two straight tube portions of the fin fixing tube each having the finless part between each pair of adjacent fin groups.

3. A heat exchanger finned tube according to claim 1 wherein

the finless part is in excess of 5 mm in length, and portions bearing no clamp mark and included in the finless part are up to 5 mm in length.

4. A heat exchanger finned tube according to claim 1 wherein the fin fixing tube is integrally provided on an inner peripheral surface thereof with inner fins extending longitudinally thereof and arranged at a spacing circumferentially thereof.

5. A heat exchanger finned tube according to claim 4 wherein the fin fixing tube has high and low two kinds of inner fins alternately arranged circumferentially thereof and projecting from the inner peripheral surface of the tube to different heights, the high inner fins being 0.7 to 1.7 mm in height from the surface of the fin fixing tube, the low inner fins being 0.4 to 1.2 mm in height from the surface.

6. A heat exchanger finned tube according to claim 4 wherein all the inner fins are equal in height and 0.7 to 1.2 mm in height from the inner peripheral surface of the fin fixing tube.

7. A heat exchanger finned tube according to claim 5 or 6 wherein the pitch of the inner fins is 0.4 to 1.6 mm.

8. A heat exchanger comprising a heat exchanger finned tube which has a fin fixing tube having a straight tube portion and comprising a tube having no weld seam, and a fin group comprising a plurality of parallel plate fins fixed to the straight tube portion of the fin fixing tube, the straight tube portion having at least one finless part provided with no fin group, each of the plate fin having a tube inserting hole, the fin fixing tube having its straight tube portion

inserted through the holes of the plate fins and being enlarged with use of a fluid to thereby fixedly fit the plate fins around the straight tube portion, the finless part of the straight tube portion having an outer peripheral surface bearing annular clamp marks left by clamping the straight tube portion over the entire circumference thereof when the fin fixing tube is enlarged, the heat exchanger finned tube being bent at said at least one finless part of the straight tube portion of the fin fixing tube.

9. A heat exchanger comprising a heat exchanger finned tube which has a fin fixing hairpin tube having two straight tube portions and comprising a tube having no weld seam, and a plurality of fin groups arranged on the two straight tube portions of the fin fixing tube longitudinally thereof at a spacing, each of the fin groups comprising a plurality of parallel plate fins extending across and fixed to the two straight tube portions, each of the straight tube portions having at least one finless part provided with no fin group, each of the plate fins having two tube inserting holes spaced apart from each other, the fin fixing tube having its straight tube portions inserted through the respective holes of the plate fins and being enlarged with use of a fluid to thereby fixedly fit the plate fins around the straight tube portions, the two straight tube portions of the fin fixing tube each having the finless part between each pair of adjacent fin groups, the finless part of each straight tube portion having an outer peripheral surface bearing annular clamp marks left by clamping the straight tube portion over the entire circumference thereof

when the fin fixing tube is enlarged, the finned tube being formed in a zigzag shape in its entirety by bending in the same direction each pair of finless parts located in the same position with respect to the longitudinal direction of the straight tube portions of the fin fixing tube, and bending in different directions each pair of finless parts adjacent to each other longitudinally of the straight tube portions.

10. A refrigerator which comprises a refrigeration cycle having a compressor, a condenser and an evaporator, the evaporator being a heat exchanger according to claim 8 or 9, and wherein a hydrocarbon refrigerant is used as the refrigerant.

11. A refrigerated showcase which comprises a refrigeration cycle having a compressor, a condenser and an evaporator, the evaporator being a heat exchanger according to claim 8 or 9, and wherein a hydrocarbon refrigerant is used as the refrigerant.

12. An apparatus for producing a heat exchanger finned tube comprising a fin setting jig composed of a plate base and a plurality of fin support plates provided upright on the plate base and arranged in parallel at a spacing, tube clamp lower plates arranged in respective fin setting clearances between adjacent fin support plates of the fin setting jig, tube clamp upper plates arranged on the respective lower plates between the adjacent fin support plates and a pressure member for pressing the upper plates downward, each of the fin support plates having a cutout formed in an upper edge thereof for a straight tube portion of a fin fixing tube to fit in, each

pair of corresponding tube clamp upper and lower plates having a through hole formed therebetween for inserting the straight tube portion of the fin fixing tube therethrough, the through hole having an inside diameter not smaller than the outside diameter of the fin fixing tube.

13. An apparatus for producing a heat exchanger finned tube according to claim 12 wherein each of the fin support plates has two cutouts formed as spaced apart in the upper edge thereof for two straight tube portions of a fin fixing hairpin tube to fit in, and each pair of corresponding tube clamp upper and lower plates have two through holes formed therebetween for inserting the two straight tube portions of the fin fixing tube therethrough, the through holes having the same pitch as the two cutouts.

14. An apparatus for producing a heat exchanger finned tube according to claim 12 wherein the plate base of the fin setting jig comprises a plurality of base units arranged in series, and fin support plates are provided upright on each of the base units.

15. An apparatus for producing a heat exchanger finned tube according to claim 12 wherein the tube clamp upper and lower plates are each 0.8 to 1.0 mm in thickness.

16. A process for producing a heat exchanger finned tube according to claim 1 which process includes preparing a fin fixing tube having a straight tube portion and comprising a tube having no weld seam, and a plurality of plate fins each having a tube inserting hole, arranging the plate fins in respective fin setting clearances arranged in succession at

a portion where a fin group is to be provided, among fin setting clearances between all fin support plates of a production apparatus according to claim 12, arranging tube clamp lower plates in the respective fin setting clearances having no plate fin disposed therein, inserting the straight tube portion of the fin fixing tube through the tube inserting holes of the plate fins and fitting the straight tube portion into cutouts of the fin support plates to provide on the straight tube portion a fin group comprising the plate fins as arranged in parallel and a finless part, arranging tube clamp upper plates on the respective tube clamp lower plates, with the straight tube portion of the tube extending through a hole formed between each pair of corresponding upper and lower plates, pressing the upper plates downward by a pressure member, and introducing a fluid into the fin fixing tube to enlarge the tube and fixedly fit the plate fins of the fin group around the straight tube portion.

17. A process for producing a heat exchanger finned tube according to claim 2 which process includes preparing a fin fixing hairpin tube comprising a tube having no weld seam, and plate fins each having two tube inserting holes, arranging the plate fins in respective fin setting clearances arranged in succession at portions where respective fin groups are to be provided, among fin setting clearances between all fin support plates of a production apparatus according to claim 13, arranging tube clamp lower plates in the respective fin setting clearances having no plate fin disposed therein, inserting two straight tube portions of the fin fixing tube through the

respective tube inserting holes of each of the plate fins and fitting the straight tube portions respectively into two cutouts of each of the fin support plates to provide fin groups each comprising a plurality of plate fins as arranged in parallel and finless parts, arranging tube clamp upper plates on the respective tube clamp lower plates, with the straight tube portions of the tube extending respectively through two holes formed between each pair of corresponding upper and lower plates, pressing the upper plates downward by a pressure member, and introducing a fluid into the fin fixing tube to enlarge the tube and fixedly fit the plate fins of the fin groups around the straight tube portions.

18. A process for producing a heat exchanger finned tube according to claim 16 or 17 wherein assuming that the hole formed between the corresponding tube clamp upper and lower plates has an inside diameter D, and that the straight tube portion of the fin fixing tube before enlargement has an outside diameter d, these diameters have the relationship of $d \leq D \leq d + 0.4$ mm.

19. A process for producing a heat exchanger finned tube according to claim 16 or 17 wherein assuming that the combined area of contact of the tube clamp upper plates with the fin fixing tube is A, and that the pressure of the fluid introduced into the fin fixing tube is P, the force to be applied by the pressure member for pressing the upper plates downward is set at not smaller than $A \times P$.

20. A process for producing a heat exchanger finned tube according to claim 16 or 17 wherein the fin fixing tube is

integrally provided on an inner peripheral surface thereof with inner fins extending longitudinally thereof and arranged at a spacing circumferentially thereof.

21. A heat exchanger finned tube according to claim 20 wherein the fin fixing tube has high and low two kinds of inner fins alternately arranged circumferentially thereof and projecting from the inner peripheral surface of the tube to different heights, the high inner fins being 0.7 to 1.7 mm in height from the surface of the fin fixing tube, the low inner fins being 0.4 to 1.2 mm in height from the surface.

22. A heat exchanger finned tube according to claim 20 wherein all the inner fins are equal in height and 0.7 to 1.2 mm in height from the inner peripheral surface of the fin fixing tube.